



UNIVERSITY UNDERGRADUATE STUDY PROGRAMME OF GEODESY AND GEOINFORMATICS

2018

The University Undergraduate Study Programme of Geodesy and Geoinformatics at the Faculty of Civil Engineering, Architecture and Geodesy lasts three academic years and is divided into six semesters.

The curriculum consists of compulsory and elective courses. It is harmonised with the European Credit Transfer and Accumulation System (ECTS) of the European Higher Education Area (EHEA) and students earn a minimum of 60 ECTS credits per academic year. In order to obtain the qualification (bachelor's degree, first cycle), students must earn a minimum of 180 ECTS credits.

After graduation, students are awarded the academic title and corresponding qualification of University Bachelor of Geodesy and Geoinformatics, univ. bacc. in geodesy and geoinformatics). Students may continue their studies at university or professional graduate study programmes in geodesy and/or geoinformatics or similar engineering fields or enter the labour market.

1. INTRODUCTION

1.1. Assessment of the feasibility of the study

More than 80% of the information that surrounds us contains information about space. Maps, plans, geodetic surveys, GIS and navigation satellite systems are just some of the ways that help us to define spatial information when making decisions about spatial management, spatial planning, environmental protection, the construction of buildings or other interventions in space.

Geodesy already existed in the early days of civilisation. In ancient Egypt, for example, the area flooded by the Nile was systematically surveyed in order to determine the plots of land to be built on. The collection, processing and exchange of spatial information plays an increasingly important role in the market economy, but also in the everyday lives of citizens. Spatial knowledge is becoming one of the fundamental pillars of knowledge necessary for the development of society as a whole, and the dynamic development of the economy and geoinformatics places new demands on the necessary knowledge and skills every day. For this reason, geodesy and geoinformatics play an important role in the development of the economy and society as a whole.

Engineers and later bachelor's and master's graduates in geodesy and geoinformatics have never had difficulty finding employment, and the current situation in the labour market is such that graduates of geodesy and geoinformatics can find employment in a short time throughout the Republic of Croatia (according to research by the Croatian Chamber of Certified Geodetic Engineers, there is a minor problem with employment in Zagreb County). In the southern part of the Republic of Croatia, in Dalmatia and its hinterland (Šibenik-Knin County; Zadar; Split-Dalmatia County and Dubrovnik-Neretva County), there is a constant need for geodetic professionals.

In the mid-seventies of the last century, the Secondary School of Geodesy was opened, which alleviated the need for geodetic technicians, but with the opening of the University Undergraduate Study Programme of Geodesy and Geoinformatics in the academic year 2010/2011, there was significant coverage of the regional market. This is due to the fact that students who complete their undergraduate studies in Split, and mostly enrol at the Faculty of Geodesy at the University of Zagreb for graduate study, usually return to their areas of provenance, thus covering a large part of the demand in the southern part of the Republic of Croatia.

Private companies and the public sector provide scholarships and support students in other ways to produce quality professionals. Similarly, a large number of high school graduates express their interest in studying geodesy and geoinformatics at the University of Split. Many high school graduates from the region find it difficult to fund their studies in Zagreb or outside the Republic of Croatia, so this type of study is necessary for the further development of the profession in Dalmatia and its hinterland.

1.2. Collaboration with the local community (economy, entrepreneurship, civil society...)

The Republic of Croatia declares itself as a country of knowledge, so more and more skilled experts in the field of geodesy and geoinformatics are needed. The interest shown so far by the economy, public sector and institutions, as well as the local community in all four Dalmatian counties and beyond, reinforces our conviction that the proposed curriculum provides the basis for modern education for both professional and scientific research and teaching activities.

The development of higher education in the field of geodesy and geoinformatics shows that the Faculty of Civil Engineering, Architecture and Geodesy at the University of Split is one of the leaders in the Republic of Croatia. The University Undergraduate Study Programme of Geodesy and Geoinformatics at the Faculty of Civil Engineering, Architecture and Geodesy is the starting point for professions in the field of spatial management. Similar faculties work in the same or similar ways in the region, in Europe and around the world.

The Faculty of Civil Engineering, Architecture and Geodesy is based on the unity of scientific research, teaching and professional activity. All areas of activity complement each other and lead to positive interaction, the result of which is the prosperity of the Faculty and all its internal and external stakeholders. Every few years, the Faculty updates the existing curricula in accordance with the needs of the economy and modern scientific achievements.

Public institutions and the private sector (State Geodetic Administration, Hydrographic Institute, Croatian Chamber of Architects and Engineers for Geodesy) are interested in this type of study programme. They have all participated in the establishment of the University Undergraduate Study Programme of Geodesy and Geoinformatics in Split. The cooperation is also reflected in the participation of experts in the teaching process, but also in the practical training of students in these institutions (external cooperation, donations and exchange of geodetic instruments, student visits and student internships).

1.3. Compliance with the requirements of professional organisations

The Faculty of Civil Engineering, Architecture and Geodesy of the University of Split continuously cooperates with professional organisations (Croatian Geodetic Society, Croatian Chamber of Geodetic Engineers, Croatian Cartographic Society, Association of Geodetic Surveyors of Dalmatia) and business associations (Croatian Employers' Association – Association of Employers in the Geodetic and Geoinformatics Profession and Association of Employers in the IT Profession). The study programme is tailored to the requirements of the Croatian Chamber of Geodetic Engineers.

1.4. Partners outside the higher education system

The Faculty of Civil Engineering, Architecture and Geodesy cooperates with state administrative bodies (primarily the State Geodetic Administration and the Regional Cadastre Office Split, as well as other ministries and government agencies) and scientific institutions (Croatian Hydrographic Institute, Split), as well as the Civil Engineering and Geodesy High School of Split on the implementation of study programmes and activities.

Current and future partners interested in the study programme are geodetic and geoinformatics companies from the wider region (Geoprojekt d.d., Geodetski zavod d.d., GISplan d.o.o., Aces d.o.o., Podloga d.o.o., etc.) which help with the execution of professional practice, part of the fieldwork and visits to geodetic and hydrographic works (cadastral surveys, land consolidation, large infrastructure projects, large industrial plants, hydrographic surveys, etc.).

Current and future partners interested in the study programme are also IT and geoinformatics companies with whom the Faculty collaborates and whose software packages are used in teaching (Esri, Autodesk, Microsoft, Studio Art, Topocad, ZW CAD, ProgeCAD, etc.).

1.5. Funding

The University Undergraduate Study Programme of Geodesy and Geoinformatics in Split is funded by the Ministry of Science, Education and Youth and partly financed from the own funds of the Faculty of Civil Engineering, Architecture and Geodesy of the University of Split. Since this is a relatively new study, which was introduced in a time of difficult economic situation, it is materially supported (with one-time donations) by the University of Split and

Split-Dalmatia County. Some of the geodetic companies have donated or lent geodetic instruments, which has also facilitated the delivery of the study programme.

1.6. Comparability of the study programme with the programmes of accredited higher education institutions in Croatia and the European Union

Since the academic year 2010/2011, the Faculty of Civil Engineering, Architecture and Geodesy at the University of Split has been conducting the University Undergraduate Study Programme of Geodesy and Geoinformatics, which was modelled after the study programme of the Faculty of Geodesy at the University of Zagreb. Together with the University Undergraduate Study Programme of Geodesy and Geoinformatics in Split, this is the only programme of its kind in the Republic of Croatia. The study programmes are almost completely coordinated and differ in the range of elective subjects offered.

The study programme is based on the study programmes in geodesy and geoinformatics at universities in Central and Western Europe (countries where spatial administration is organised similarly to the Republic of Croatia and the role of surveyors in society is similar – e.g. Austria, Germany, Switzerland, the Netherlands, etc.). Thus, this study programme is comparable to the programmes of TU Graz, TU Munich, ETH Zurich and TU Delft as guardians of the European tradition of educating geodetic experts in higher education. The study programme provides a high level of technical knowledge required to fulfil tasks in geodesy and geoinformatics.

Teachers at the Faculty of Geodesy at the University of Zagreb have analysed many study programmes and their content, as presented in the paper by Frančula N. and Lapaine M.: Studies of Geodesy and Geoinformatics in Europe, *Geodetski list* 2011, 2, 145–156 (http://hrcak.srce.hr/index.php?show=clanak&id_clanak_jezik=107193); and expanded in the paper Frančula N: Studies of Geodesy, Geoinformatics and Geomatics in the World, Faculty of Geodesy, September 2013, 1-39 (<http://www.geof.unizg.hr/mod/forum/discuss.php?d=135>).

For comparison, the website links to the undergraduate study programme in Geodesy and Geoinformatics are provided below

1. University of Technology in Vienna, Austria:
https://www.tuwien.ac.at/fileadmin/t/studabt/downloads/Studienplaene/Oktober_2014/Bach_Geodaesie_Geoinformatik.pdf;
2. Leibnitz University in Hanover, Germany:
<http://www.uni-hannover.de/en/studium/studiengaenge/geodaesie/>.

1.7. Openness of the study programme towards student mobility (horizontal, vertical in the Republic of Croatia and international)

As far as horizontal mobility is concerned, the University Study Programme of Geodesy and Geoinformatics in Split is primarily oriented towards the undergraduate study programme of

the Faculty of Geodesy at the University of Zagreb, but also towards other geodetic and geoinformatics programmes within the EU Member States and the countries of the region (Slovenia, Bosnia and Herzegovina, Serbia, Macedonia).

Vertical mobility is possible within the framework of graduate studies and later postgraduate studies at the Faculty of Geodesy at the University of Zagreb and related study programmes at technical and other faculties (e.g. geography studies, etc.). Vertical mobility is also possible within the framework of graduate studies at many geodesy and geoinformatics faculties in the European Union and the countries of the region – Slovenia, Bosnia and Herzegovina, Serbia, Macedonia – and even around the world.

1.8. Harmonisation with the mission and strategy of the University and the Faculty and with the strategic document of the Network of Higher Education Institutions

The University Undergraduate Study Programme of Geodesy and Geoinformatics in Split is in line with the University of Split Strategy 2015 - 2020 (Mission, Vision and Strategic Guidelines). In addition to the mission and vision of the University of Split, the following strategic documents were used as guidelines when defining the strategic goals:

- European Strategy for Smart, Sustainable and Inclusive Growth EUROPE 2020;
- Strategic documents of the European Research Area (ERA);
- Strategic documents of the European Higher Education Area (EHEA);
- Strategy for Education, Science and Technology of the Republic of Croatia.

The development of this study programme is in line with the mission, vision and goals based in part on the University of Split Scientific Strategy 2009 – 2014, which encourages its constituents to create internal development plans.

The University Undergraduate Study Programme of Geodesy and Geoinformatics in Split is in line with the development guidelines of the Faculty of Civil Engineering, Architecture and Geodesy of the University of Split, as well as with the mission, vision and strategic goals set out in the Development Strategy of the Faculty of Civil Engineering, Architecture and Geodesy of the University of Split for the period 2012 – 2016. A new development strategy of the Faculty is currently being prepared, in which goals, sub-goals and activities for geodesy and geoinformatics will be defined and harmonised. In addition, the study programme is aligned with the Strategic Programme of Scientific Research of the Faculty of Civil Engineering, Architecture and Geodesy for the period 2015 – 2020, which lists the development directions and scientific topics of this discipline, for example geoinformation systems (GIS), geoinformatics, semantic modelling; definition of spatiotemporal data of the coastal zone; creation of 3D models of buildings with application in the protection of cultural heritage, records of buildings, power lines, etc.; high-precision measurements in the monitoring of object deformations (e.g. dam auscultation); coastal and marine management.

The study programme is also in line with the strategic document of the Network of Higher Education Institutions and Study Programmes in the Republic of Croatia, which encourages the opening of study programmes in STEM fields, including the proposed study programme.

1.9. Previous experience with the implementation of equivalent or similar programmes

The study programme in Geodesy and Geoinformatics at the Faculty of Civil Engineering, Architecture and Geodesy at the University of Split has been delivered since the academic year 2010/2011. For seven years, the teaching staff have gained new experience in teaching and non-teaching activities. Based on this experience and student feedback (including student surveys, but also verbal feedback), numerous improvements have been made.

The Faculty of Geodesy at the University of Zagreb has many years of experience with a similar programme, so their experience was largely incorporated into the development of the Split study programme. On this basis, certain courses were amended and some new courses were added to the study programme.

2. SYLLABUS

The table below shows information for the academic year 2023/24. Detail plans for specific semesters and academic years are published on the following Faculty's website: [link](#).

Teacher	Course	Related learning outcomes	Teaching and learning	Assessment	Code	Hours	ECTS
I. semester							
J. Sedlar	Analytical geometry and linear algebra	d	1, 2	1, 2	GAB031	30+30	5
S. Banić	Mathematical analysis	d	1, 2	1, 2	GAB032	30+30	5
N. Leder	Physics	d	1, 2	1, 2	GAB033	30+30	5
M. Baučić	Basics of geoinformatics	a,h,i	1, 3, 4	1, 2	GAZ001	30+30	5
I. Racetin	Geodetic instruments	a,e	1, 5	1, 2	GAZ002	30+30	5
I. Racetin	Engineering graphics in geodesy and geoinformatics	a,g,h,j	1, 3	1, 2	GAZ003	15+30	3
Elective courses (min. 2 ECTS)							
J. Sedlar, S. Pavasović	Basics of computer science	g,h,i,k	1, 3	1, 2	GAB034	15+15	2
T. Duplančić-Leder	Introduction to geodesy	a,m,n	1	1, 2	GAZ004	30+0	2
II. semester							
N. Lovričević	Computer geometry	d,h	1, 2, 3	1, 2	GAC031	30+30	5
Lj. Šerić	Programming	i,j	1, 3	1, 2	GAB035	30+30	5
J. Kilić; Ž. Hećimović	Land surveying	a,e,f,g,k	1, 3, 4	1, 2	GAZ005	30+60	5
J. Kilić; I. Racetin	Field measurements	a,e,f,g,k,l	1, 3, 4	1, 2	GAZ006	30+30	5
S. Ivelić Bradanović	Basics of statistics	d	1, 3	1, 2	GAB036	30+15	4
S. Ivelić Bradanović	Vector analysis	d	1, 2	1, 2	GAB037	30+15	3
Elective courses (min. 3 ECTS)							
V. Kukoč	Introduction to architecture	c,g,h	1	1, 3	GAU001	30+0	3
S. Banić	Spherical trigonometry	d	1, 2	1, 2	GAB038	15+15	3
I. Škarica	Basics of professional English	l,m,n	1, 3	1, 3	GAA032	15+15	3

Teacher	Course	Related learning outcomes	Teaching and learning	Assessment	Code	Hours	ECTS
III. semester							
M. Baučić	Databases	a,i,j	1, 3	1, 2	GAZ007	30+30	5
J. Sedlar	Differential geometry	d	1, 2	1, 2	GAB039	30+30	5
M. Baučić	Analysis and processing of geodetic measurements	a,d,f,k	1, 2	1, 2	GAZ008	30+45	5
Ž. Hećimović	Geodetic maps	a,g,h	1, 3	1, 2	GAZ009	30+30	5
J. Čizmić	Principles of land registration law	b,c,g,m,n	1	2	GAZ010	30+0	2
Elective courses (min. 8 ECTS)							
I. Racetin	Topography	a,h,i	1	1, 2	GAZ011	30+0	3
D. Cvitanić; D. Breški	Roads	G	1, 2, 3	1, 2	GAF121	30+30	5
Ž. Hećimović	Professional practice out of the Faculty	a,e,f,g	6	1, 2	GAZ035	0+80	3
IV. semester							
I. Racetin	Cartography	a,g,h,i	1, 3	1, 2	GAZ012	30+30	5
Ž. Hećimović	Geodetic reference frames	a,d,g,k	1, 3	1, 2	GAZ013	30+30	5
M. Baučić	Photogrammetry	a,f,g,j,k,l	1, 3, 4	1, 2	GAZ014	30+30	5
I. Racetin	Cadastre	a,b,c,f,g,i	1, 3	1, 2	GAZ015	30+45	5
M. Baučić	Geoinformation modelling	a,h,i,j	1, 3	1, 2	GAZ016	30+30	5
Elective courses (min. 5 ECTS)							
I. Racetin	Geoinformation quality	(a,c,f,g,h,i,k.m.n)	1, 3	1, 2	GAZ017	30+30	5
I. Racetin	Geoinformation management	(a,h,i)	1, 3	1, 2	GAZ018	30+30	5
V. semester							
Lj. Vrdoljak	Satellite positioning	a,e,f,g,j,k	1, 3, 4	1, 2	GAZ019	30+30	5
Ž. Hećimović	Engineering geodetic control	a,e,f,g,k	1, 3, 4	1, 2	GAZ020	30+30	5
T. Duplančić Leder	Remote sensing	a,f,g,j,k	1, 3	1, 2	GAZ021	30+30	5
Ž. Hećimović	Land development	a,b,g	1, 3	1, 2	GAZ022	30+30	5
M. Baučić	Professional practice	a,e,f,g	3	1	GAZ033	0+45	3
Elective courses (min. 7 ECTS)							
Ž. Hećimović	Practical work with geodetic instruments	a,e,k	4, 5	1, 2	GAZ024	15+15	2

Teacher	Course	Related learning outcomes	Teaching and learning	Assessment	Code	Hours	ECTS
T. Duplančić Leder	Land information systems	a,i	1, 3	1, 2	GAZ025	30+30	5
I. Racetin	Topographic cartography	a,h,i	1, 3	1, 2	GAZ026	30+30	5
I. Bilić	Business communication	M	1, 2	1, 3	GAA031	15+15	2
VI. semester							
Ž. Hećimović	Engineering geodesy	a,e,f,g,k	1, 4	1, 2	GAZ027	30+30	5
T. Bašić	State survey	a,d,f,g,k	1, 3	1, 2	GAZ028	30+30	5
M. Baučić	Map projections	a,g,h,i	1, 3	1, 2	GAZ029	30+30	5
T. Duplančić-Leder	Hydrographic survey	a,f,g,k	1, 3	1, 2	GAZ030	30+30	5
M. Baučić	Final exam	a-n	1	1	GAZ050	0+30	2
Elective courses (min. 8 ECTS)							
N. Jajac	Introduction to management	l,n	1, 2	1, 3	GAL031	15+15	2
V. Denić-Jukić	Selected hydrological topics	B	1, 3	1, 2	GAI021	15+15	3
I. Racetin	Web cartography	a,h,i,j	1, 3	1, 2	GAZ032	15+15	3
J. Sedlar	Discrete mathematics	D	1, 2	1, 2	GAB040	30+30	5
Ž. Hećimović	Geoinformation infrastructure	a,c,i	1, 3	1, 2	GAZ031	30+30	5

Learning outcomes – University Undergraduate Study of Geodesy and Geoinformatics

Label	Units of learning outcomes
a	To evaluate measurement methods, technologies, computation and visualisation of measurements and geospatial data.
b	To critically assess and to develop real estate registrations, land development actions and methods for land valuation.
c	To independently interpret the laws and regulations governing geodetic and geoinformatic tasks.
d	Recommend and apply mathematical and physical methods in solving non-standard geodetic and geoinformatic tasks.
e	To independently operate with and examine the validity of geodetic instruments and measuring accessories.
f	To perform geodetic measurements independently and evaluate their quality.
g	To plan and independently perform geodetic works on state survey, maintenance of real estate registrations, construction of buildings, valuation and real estate management.
h	To design and independently compose large and small-scale maps and geospatial analysis.
i	To independently maintain geospatial databases and geographic information systems.
j	To propose the application of recently developed information technologies for the collection, processing and management of data.
k	To differentiate the sources and nature of errors in geodetic measurements or computer data processing and select the method for error removal.
l	To organize teamwork on jobs in office or field in cases where the task is more complex, has large volume or has long duration.
m	To communicate with parties and geodetic and related experts in the interpretation of regulations, standards and norms, interpretation of results, and prevention of possible misunderstandings.
n	To evaluate and plan the professional development of team members in conditions of intensive development of technology and services, legal framework, and professional norms and standards.

Teaching and learning:

1. Lectures: a teacher teaches ex-cathedra or uses some form of interactive lectures.
2. Theoretical exercises: a teacher demonstrates to students how to solve standard mathematical or engineering tasks.
3. Practical exercises: students solve and prepare practical assignments under the supervision of the teacher in standard or IT-equipped classrooms.
4. Field exercises: students and teachers visit relevant companies, or students perform small-scale practical work and measurements outdoors, etc.
5. Lab exercises: the teacher demonstrates experiments/tasks to students, or students perform their own experiments/tasks in the laboratory under the supervision of teachers and/or technicians.
6. Internship: students perform practical work at relevant companies during semester or summer vacations.
7. Independent work: theoretical or practical assignment under the supervision of a teacher.

Assessment:

1. Written exams: students solve tasks as the paperwork or by a computer in IT-equipped classrooms. They may be performed throughout the semester or during the examination period.
2. Oral exams: a teacher poses questions to students in a spoken form.
3. Presentation or defence of a practical or written assignment.